

HERBIVOROUS INSECTS ASSOCIATED WITH THE PAPERBARK *MELALEUCA QUINQUENERVIA* AND ITS ALLIES: IV. TORTRICIDAE (LEPIDOPTERA)

J.K. BALCIUNAS^{1,4}, D.W. BURROWS² and M. HORAK³

¹ United States Department of Agriculture, Australian Biological Control Laboratory, Kevin Stark Research Building, James Cook University, Townsville, Qld, 4811

² Australian Centre for Tropical Freshwater Research, Australian Biological Control Laboratory, James Cook University, Townsville, Qld, 4811

³ CSIRO, Division of Entomology, G.P.O. Box 1700, Canberra, A.C.T. 2601

Abstract

We conducted surveys in northern and southeastern Queensland and in northern New South Wales to detect potential agents for the biological control of *Melaleuca quinquenervia* in Florida, USA, where it has become a serious pest. This paper presents records for 21 taxa of tortricid moths collected and reared on six *Melaleuca* species. Several of these Tortricidae may deserve further study as potential biocontrol agents for *M. quinquenervia*.

Introduction

Despite the diversity (around 250 species) and wide distribution of *Melaleuca* spp. (Barlow 1988), the herbivores associated with this genus are poorly known. The paperbark trees in the *Melaleuca leucadendra* (L.) L. complex (Blake 1968) are conspicuous and widespread along Australia's eastern and northern coastlines. Since its introduction as an ornamental in southern Florida, U.S.A. at the beginning of the century, *Melaleuca quinquenervia* (Cav.) S.T. Blake, a member of this complex, has become a serious pest. Since late 1986 we have regularly collected insect herbivores in Australia associated with *M. quinquenervia* and its close relatives in the *M. leucadendra* complex, in order to determine those that may have potential as biocontrol agents. We have presented records for 22 species of Noctuoidea (Balciunas *et al.* 1993a), 17 species of Geometridae (Balciunas *et al.* 1993b) and 31 species of Gelechioidea (Burrows *et al.* 1994) which we reared from *M. quinquenervia* and its close relatives. In this paper we present collection and rearing records for 21 taxa of Tortricidae. All are apparently new host records.

Methods

Nearly all the tortricids were collected as larvae, and reared on the tree species from which they were collected. Most were collected in quantitative samples (described in Balciunas *et al.* 1993a) from 1986-1993. These consisted of approximately 1 kg of plant material, collected in the field, then sorted in the laboratory. The remaining Tortricidae were collected directly from trees in the field or at our shadehouses. Adults were identified by one of the authors (M. Horak) as far as possible. Many tortricid genera are in need of revision and the generic classification of the Australian myrtaceous-feeding representatives of the tribe Eucosmini is totally inadequate. The names used in this paper are

⁴ Present Address: United States Department of Agriculture, Biological Control of Weeds Research Unit, Albany, California, U.S.A., 94710

Table 1. Tortricidae species reared from *Melaleuca quinquenervia* and eight other myrtaceous tree species.

Species	Collection site	Host plant ¹	Stage and no. collected	Date collected	Plant part fed upon	Life-history information (pp = pupal period)
Tortricinae						
<i>Archipini</i>						
<i>Adoxophyes templana</i> (Pagenstecher)	Cardwell Swamp	Larva	Mqn	18.viii.86	Tip-binder	Adult emerged 3.xiii.89
<i>Adoxophyes</i> sp. B	James Cook University	Larva	Mqn	1.viii.91	Leaf-binder	Adult emerged 26.viii.91, pp=8 d
<i>Adoxophyes</i> sp. C ²	Howard River	Larva	Mnv	24.x.86	Leaf-binder	Adult emerged
<i>Adoxophyes postvitana</i> (Walker) ³	Forrest Beach West	Larva	Mqn	29.ix.92	Leaf-grazer	Adult emerged before 19.xi.92
<i>Isotenes cf. miserrana</i> (Walker) ⁴	Redbank	Larva	Mqn	27.v.87	Flowers	Adult emerged
	Byron Bay Industrial Park	Larva	Mqn	17.vii.88	Flowers	Adult emerged
	Daintree Swamp	Larva	Mcj	8.vi.92	Leaf-binder	Adult emerged 30.vi.92
	Daintree Swamp	Larva	Mcj	5.vii.93	Leaf-binder	Adult emerged 9.viii.93, pp=8 d
	Eubenangee Swamp	Pupa	Mqn	3.viii.87		Adult emerged 10.viii.87
	Eubenangee Swamp	2 larvae	Mqn	15.ix.87		2 adults emerged 6.x.87
	Eubenangee Swamp	Pupa	Mqn	7.viii.89	Tip-binder	Adult emerged 16.viii.89
	Feluga Site 1	Larva	Mqn	23.viii.93	Tip-binder	Adult emerged 16.xi.93
	Forrest Beach West	Larva	Mqn	4.xi.93	Tip-binder	Adult emerged
	Hubinger Road	Larva	Mqn	12.x.93	Leaf-binder	Adult emerged 3.xi.93
	Hubinger Road	2 larvae	Mqn	4.xi.93	Leaf-binder	2 adults em. 26.xi.-2.xii.93, pp=9 d
	Indooopilly	Larva	Mqn	1992	Inside gall ⁵	Adult emerged
	Maclean	Larva	Mqn	28.xi.88	Tip-binder	Adult emerged 13.xii.88
	Maclean	Larva	Mqn	10.x.89		Adult emerged 22.xi.89, pp=12 d
	Maclean	Pupa	Mqn	20.iii.90		Adult emerged 27.iii.90
	Maclean	Larva	Mqn	19.xi.90	Leaf-binder	Adult emerged 12.xii.90, pp=7 d
	Murrigal	Larva	Lsv	5.xi.93	Leaf-binder	Adult emerged
	Tully Heads Road	Mqn		9.xi.93	Tip-binder	Adult emerged 23.xi.93
	Tully Heads Road	Mlb		9.xi.93	Tip-binder	Adult emerged 17.xii.93, pp=9 d

3 adults em. 18.ix.-2.x.92, pp=7-9 d	Tip-binder	3.ix.92	3.ix.92	Mqn	3 larvae	Woodward Park
7 adults emerged 7-10.x.ii.92	Leaf, tip-binder	9.xi.92	9.xi.92	Mqn	7 larvae	Woodward Park
Adult emerged 4.x.93, pp=7 d	Leaf-binder	12.ix.93	12.ix.93	Mqn	Larva	Woodward Park
Adult emerged 10.xi.93, pp=5 d	Leaf-binder	25.x.93	25.x.93	Mqn	Larva	Woodward Park
Adult ♂ emerged		6.v.91	6.v.91	Mqn	Larva	Daintree Swamp
Adult emerged	Tip-binder	29.ix.92	29.ix.92	Mqn	Larva	Feluga Site 1
Adult emerged	Tip-binder	12.ix.92	12.ix.92	Mqn	Larva	Forrest Beach West
Adult emerged 1.xi.93, pp=6 d	Tip-binder	12.x.93	12.x.93	Mqn	Larva	Forrest Beach West
Adult emerged 5.xi.93, pp=7 d	Leaf-binder	12.x.93	12.x.93	Mqn	Larva	Hubinger Road
Adult emerged 9.xi.93	Tip-binder	12.x.93	12.x.93	Mqn	Larva	Murrigal
9 adults em. 18.ix.-11.x.92, pp=6-10 d	Tip-binder	3.ix.92	3.ix.92	Mqn	9 larvae	Woodward Park
Adult emerged	Tip-binder	12.ix.92	12.ix.92	Mqn	Larva	Woodward Park
Adult emerged	Tip-binder	29.ix.92	29.ix.92	Mqn	Larva	Woodward Park
Adult emerged 25.xi.92	Tip-binder	9.xi.92	9.xi.92	Mqn	Larva	Woodward Park
Adult emerged 23.xi.93, pp=8 d	Tip-binder	25.x.93	25.x.93	Mqn	Larva	Woodward Park
Adult emerged	Leaves	13.v.iii.90	13.v.iii.90	Mlb	Larva	Apex Park
Adult emerged 27.v.87, pp=12 d	Flowers	4.v.87	4.v.87	Mqn	Larva	Eubanangee Swamp
5 adults emerged	Flowers	6.v.88	6.v.88	Mqn	5 larvae	Eubanangee Swamp
Adult emerged 22.vi.91, pp=15 d	Flowers	25.vii.88	25.vii.88	Mqn	Larva	Feluga Site 1
Adult emerged 18.vi.92	Flowers	20.v.92	20.v.92	Mqn	Larva	Boundary Street
Adult emerged 9.viii.91	Leaf-binder	16.viii.91	16.viii.91	Mlb	Larva	Eclipse Street
Adult emerged 2.vi.88	Flowers	6.v.88	6.v.88	Mqn	2 larvae	Eubanangee Swamp
5 adults emerged	Flowers	18.v.92	18.v.92	Mqn	5 larvae, 2 pupae	James Cook University

Isoetes sp. E6**Olethreutinae***Duda aprobola*⁷
(Meyrick)*Lobesia* cf. *pelliphora*
(Meyrick)

Table 1 (cont.). Tortricidae species reared from *Melaleuca quinquenervia* and eight other myrtaceous tree species.

Species	Collection site	Host	Stage and Plant number	Date collected	Plant part fe upon	Life history information (pp=pupal period)
<i>Lobesia cf. peltophora</i>	Oonooba	Mgn	2 larvae	19.v.93	Flowers	2 adults emerged
(cont.)	Willows Shopping Centre	Mgn	2 larvae	17.v.92	Flowers	2 adults emerged 7&12.vi.92
<i>Lobesia peltophora</i> - complex	Aspley	Mgn	Larva	21.ii.88	Flowers	Pupated 11.iii.88, failed to emerge
	Chelmer	Mgn	Larva	2.vii.92	Mlb flowers ⁸	Adult emerged 27.vii.92, pp=18 d
	Redbank	Mgn	Larva	27.v.87		Adult emerged
	Sherwood	Mgn	2 larvae	1.vii.87		2 adults emerged
	Sunnybank	Mgn	2 larvae	6.iv.87		2 adults emerged
	Taringa	Mgn	2 larvae	24.ii.92	Flowers	Pupated 2.iii.92, adult emerged
	Tennyson	Mgn	Larva	25.v.92	Mlb flowers ⁸	Adult emerged 22.vi.92, pp=19 d
	The Pines	Mgn	4 larvae	10.iv.88	Flowers	3 adults em. 28.iv.-13.v.88, pp=9-12 d
	Woodburn	Mgn	Larva	5.vi.90	Leaves	Adult emerged
	Woodward Park	Mgn	Larva	13.vii.87	Leaves	Adult emerged 30.vii.87
<i>Ophtiorrhada</i> sp.	Centenary Park	Mlb	Larva	3.viii.87	Leaves	Adult ♀ emerged
	Hyde Park Shopping Centre	Mlb	Larva	5.iii.91	Leaf-binder	Adult ♀ emerged 7.iv.91, pp=10 d
	Three Mile Creek	Mlb	4 larvae	8.iv.91	Leaf-binder	Adult ♂ emerged
Eucosmini						
<i>"Bathrotoma" guttana</i> (Meyrick)	Burpengary	Mgn	Larva	20.xi.89	Leaves	Adult emerged 16.xii.89, pp=23 d
	Burpengary	Mgn	Larva	3.i.90	Tip-binder	Adult emerged 18.i.90, pp=8 d
	Burpengary	Mgn	Larva	22.vi.92	Tip-binder	Adult emerged 20.vii.92, pp=7 d
	Chelmer	Mgn	Larva	2.vii.92	Tip-binder	Adult emerged 24.vii.92, pp=4 d
	Coolum	Mgn	Larva	11.ii.91	Inside gall ⁹	Adult emerged 27.ii.91, pp=8 d
	Ernest	Mgn	Larva	1.viii.89	Tip-binder	Adult emerged 9.ix.89, pp=16 d
	Eubanagee Swamp	Mgn	Larva	25.v.87		Adult emerged 11.vi.87
	Fitzgibbon	Mgn	Larva	5.vii.89	Tip-binder	Adult emerged 1.viii.89, pp=14 d
	Fitzgibbon	Mgn	Larva	26.vii.89		Adult emerged 28.viii.89, pp=22 d

Adult emerged	24.x.86	Larva	Mlv	Howard River
Adult ♀ 5.iii.92, pp=8 d	24.i.92	Larva	Mqn	Indooroopilly
Adult emerged 2.iii.92	21.iii.92	Larva	Mqn	Indooroopilly
Adult emerged 13.v.92, pp=14 d	21.iv.92	Larva	Mqn	Indooroopilly
Adult emerged 8.viii.91	4.vii.91	Larva	Mqn	James Cook University
Adult emerged 6.xi.89, pp=13 d	17.x.89	Larva	Mqn	Landstborough
Adult emerged	27.i.93	Larva	Mqn	Oononba
Adult emerged 12.iii.92, pp=10 d	24.ii.92	Flowers	Mqn	Taringa
Adult emerged	8.iii.89	Larva	Mqn	Tibrogargan
Adult emerged	18.iii.91	Larva	Mqn	Willows Shopping Centre
Adult emerged 17.iv.91	18.iii.91	Larva	Mqn	Willows Shopping Centre
Adult emerged 13.xi.93, pp=5 d	17.v.92	Flowers	Mqn	Willows Shopping Centre
Adult emerged 2-5.iv.91, pp=7 d	4.x.89	Tip-binder	Mqn	Ernest
Adult emerged 4.ix.89, pp=14 d	1.viii.89	Tip-binder	Mqn	Ernest
Adult emerged 28.viii.89, pp=24 d	26.vii.89	Tip-binder	Mqn	Fitzgibbon
Adult emerged 22.ix.89	26.viii.89	Tip-binder	Mqn	Fitzgibbon
Adult emerged 7.ix.89, pp=10 d	21.v.87	Tip-binder	Mqn	Landstborough
Adult emerged	22.ii.89	Larva	Mqn	Redbank
Adult emerged	14.x.89	Larva	Mqn	Sherwood
Adult emerged 24.x.89, pp=6 d	6.iv.87	Larva	Mqn	Stapilton
Adult emerged	20.v.92	Larva	Mqn	Sunnybank
Adult emerged 27.vi.93, pp=24 d	19.v.93	Larva	Mqn	Boundary Street
Adult ♂ emerged 2.iii.92	27.ii.92	Pupa	Mqn	Boundary Street
Adult emerged 27.iii.-7.iv.91	12.iii.91	Larvae	Mvr	James Cook University
6 adults emerged	12.iii.91	Larvae	Mvr	Rockingham Road
18 adults emerged 21.i.-5.ii.93	17.v.92	2 adults and pupae	Mqn	Rockingham Road
Adult emerged 18.x.93	3.x.93	Larva	Cym	Willows Shopping Centre
Adult emerged	24.x.86	Larva	Mlv	Howard River

Bathrotoma sp. B
Bathrotoma sp. E
Holocola sp. B
 Ernest
 Ernest
 Meyrick 10
Holocola thalassina

Table 1 (cont.). Tortricidae species reared from *Melaleuca quinquenervia* and eight other myrtaceous tree species.

Species	Collection site	Host	Plant number collected	Date collected	Plant part fe upon	Life history information (pp=pupal period)
<i>Holocola</i> sp. C	Angus Smith Drive	Larva	Mvr	6.ii.92	Tip-binder	Adult emerged 29.ii.92, pp=20-22d
<i>Holocola</i> sp. D	Fitzgibbon	Larva	Mqn	27.vii.89	Tip-binder	Adult ♂ emerged 2.ix.89, pp=25 d
<i>Holocola</i> sp. E	Lennox Head	Larva	Mqn	11.ix.90	Tip-binder	Adult emerged 3.x.90, pp=9 d
<i>Strepsicrutes</i> prob. <i>dyselia</i> (Turner) ¹¹	Berrimah Cons. Comm. Nursery	Larva	Mcj	28.x.86	Leaf-binder	Adult emerged 12.xi.86
Berrimah Cons. Comm. Nursery	Berrimah Cons. Comm. Nursery	Pupa	Mnv	28.x.86		Adult emerged 6.xi.86
Bracken Ridge	Larva	Larva	Mqn	1.viii.90	Tip-binder	Adult emerged 8.x.90, pp=14 d
Burpengary	Larva	Larva	Mqn	1.viii.90	Tip-binder	Adult emerged 1.x.90, pp=10 d
Double Barrel Creek	2 larvae	Mdl		4.xi.93	Tip-binder	2 adults emerged 26-30.xi.93
Eubenangee Swamp	Larva	Mqn		6.v.88	Flowers	Adult emerged 1.vi.88
Feluga Site 1	2 larvae	Mqn		23.iii.93	Tip-binder	2 adults emerged
Feluga Site 1	Larva	Mqn		12.x.93	Tip-binder	Adult emerged 5.xi.93, pp=8 d
Feluga Site 4	2 larvae	Mqn		23.viii.93	Tip-binder	Adult ♀ emerged 20.ix.93
Forrest Beach West	Larva	Mqn		1.viii.89	Tip-binder	Adult ♂ emerged
Forrest Beach West	Pupa	Mqn		12.ix.92	Tip-binder	Adult ♀ emerged 18.ix.92
Forrest Beach Swamp	2 larvae	Mqn		29.ix.92	Tip-binder	2 adults emerged 18-27.x.92
Forrest Beach Swamp	3 larvae	Mqn		4.xi.93	Tip-binder	3 adults em. 26-28.xi.93, pp=5 d
Forrest Beach Swamp	Eis			4.xi.93	Leaf-binder	Adult emerged 23.xi.93
Hubinger Road	6 larvae	Mqn		12.x.93	Tip-binder	6 adults em. 21.x.-4.xi.93, pp=7-9 d
Indooroopilly	4 larvae	Mqn		25.iii.92	Tip-binder	2 adults em. 7-9.iv.92, pp=10-11 d
Indooroopilly	2 pupae	Mqn		4.iv.92	Tip-binder	2 adults emerged 9&10.iv.92
Murrigal	Larva	Mqn		23.viii.93	Tip-binder	Adult ♀ emerged 14.ix.93
Murrigal	Larva	Mqn		12.x.93	Tip-binder	Adult emerged 27.x.93, pp=9 d
Nathan Plaza	Larva	Mqn		5.iii.91	Leaf-binder	Adult ♀ emerged 8.iv.91
Oonoomba	Larva	Mqn		27.i.93	Tip-binder	Adult ♂ emerged 16.ii.93

Woodford	Mqn	Larva	22.x.90	Tip-binder	2 adults em. 27-28.ix.93, pp=7-8 d
Woodward Park	Mqn	2 larvae	12.ix.93	Tip-binder	Adult emerged
Alva Beach	Mfl	Larva	11.ix.86	Tip-binder	2 adult ♂ em. 21-22.viii.93, pp=9-10 d
Edmund Kennedy Nat. Park	Mqn	2 larvae	11.vii.88	Tip-binder	2 adults emerged 8.viii.88
Edmund Kennedy Nat. Park	Mqn	Larva	25.viii.88	Flowers	Adult emerged 28.viii.88
Eubenangee Swamp	Mqn	3 larvae	6.v.88	Flowers	3 adults emerged
Eubenangee Swamp	Mqn	2 pupae	29.viii.88	Flowers	2 adults emerged 15&17.viii.88
Feluga Site 1	Mqn	2 larvae	15.ix.87	Flowers	2 adults emerged 2&5.x.87
Feluga Site 1	Mqn	5 larvae	15.vi.88	Flowers	Adult emerged
Feluga Site 1	Mqn	18 larvae	11.vii.88	Flowers	12 adults emerged 25.vii-8.viii.88
Feluga Site 1	Mqn	6 larvae	25.vii.88	Flowers	2 adults emerged 8-15.viii.88
Feluga Site 2	Mqn	2 larvae	11.vii.88	Flowers	Adult emerged 28.viii.88
Fitzgibbon	Mqn	Larva	1.viii.90	Tip-binder	Adult emerged 2.x.90, pp=11 d
Forrest Beach West	Mqn	2 larvae	1.viii.89	Tip-binder	2 adults emerged 23-29.viii.89, pp=16-26 d
Forrest Beach West	Mqn	3 larvae	13.viii.89	Tip-binder	3 adults emerged 1.ix.89, pp=10 d
Forrest Beach West	Mqn	5 larvae	29.ix.92	Tip-binder	Adult emerged
Forrest Beach West	Mqn	Larva	29.ix.92	Tip-binder	Adult ♂ emerged
Indooroopilly	Mqn	2 larvae	12.ii.92	Tip-binder	2 adults em. 24-27.ii.92, pp=8-10 d
Indooroopilly	Mqn	Pupa	12.ii.92	Tip-binder	Adult emerged 20.ii.92
James Cook University	Mqn	Larva	1.vii.93	Tip-binder	Adult ♀ emerged
James Cook University	Cym	Larva	29.xi.93	Tip-binder	Adult ♀ emerged
Nathan Plaza	Mqn	Larva	5.iii.91	Tip-binder	Adult emerged 21.iii.91
Oonoonba	Mqn	Larva	3.viii.93	Tip-binder	Adult ♀ emerged 27.viii.93
Pallarenda	Mflb	Larvae	16.vi.93	Tip-galls ¹²	9 adults emerged 2-20.vii.93
Pallarenda	Mflb	Larva	29.vi.93	Tip-galls ¹²	Adult ♀ emerged
Pallarenda Retirement Home	Mqn	Pupa	17.iii.89	Flowers	Adult emerged 5.iv.89
Palm Beach Soccer Club	Mqn	Larva	17.iv.88	Flowers	Adult emerged

Strepsicrates cf.
semicuneella
(Walker)¹¹

Table 1 (cont.). Tortricidae species reared from *Melaleuca quinquenervia* and eight other myrtaceous tree species.

Species	Collection site	Host Plant	Stage and number collected	Date collected	Plant part fed upon	Life history information (pp=pupal period)
<i>Strepsicrates cf. transfixa</i> (Turner) ¹¹	Pottsville	Mqn	Larva	17.viii.88	Tip-binder	Adult emerged
	Rowes Bay Golf Club	Mlb	Larva	21.vii.86		Adult emerged
	Willows Shopping Centre	Mqn	Larva	3.viii.93	Tip-binder	Adult ♀ em. 20.viii.93, pp=11 d
	Woodward Park	Mqn	2 larvae	29.vii.88	Tip-binder	2 adults emerged 28.viii.88
	Woodward Park	Mqn	13	7.viii.89	Fruit	Adult emerged
	Woodward Park	Mqn	Larva	9.vii.90		Adult emerged
	Woodward Park	Mqn	2 pupae	3.ix.92		2 adult ♀ emerged 17-18.ix.92
	Feluga Site 1	Mqn	Larva	11.vii.88		Adult emerged 31.vii.88
	Caloundra	Mqn	Larva	18.vii.89	Tip-binder	Adult ♀ emer. 26.viii.89, pp=21 d
	Ernest	Mqn	Larva	4.x.89	Tip-binder	Adult ♀ emerged 19.x.89, pp=13 d
	James Cook University	Mqn	Larva	1.vii.93	Tip-binder	Adult ♂ emerged
	James Cook University	Cvm	Larva	29.xi.93	Tip-binder	Adult ♂ emerged 11.xii.93
	Pallarenda	Mlb	Larva	16.vi.93	Tip-galls ¹²	Adult emerged 6.vii.93

1 Mqn = *M. quinquenervia*, Mcj = *M. cajuputi*, Mdl = *M. dealbata*, Mlb = *M. leucadendra*, Mnv = *M. nervosa*, Mvr = *M. viridiflora*, Cvm = *Callistemon viminalis*, Ets = *Eucalyptus ?tessellaris*, Lsv = *Lophostemon suaveolens*.

2 Probably an undescribed species.

3 A notorious pest with over 250 host plants in New Zealand alone (Suckling *et al.* 1990), plus others listed in Common (1990) and Swaine *et al.* (1991).

4 *Isotenes miserana* feeds on the leaves of many trees and also on the fruit of economic crops (Common 1990).

5 Larva fed and pupated within a "fleshy-tip" gall formed by *Fergusonina* sp. (Diptera: Fergusoninidae).

6 Probably an undescribed species. Looks similar to *I. miserana* but ♀ has a dark grey anal tuft.

7 *Dudua aprohola* is a polyphagous minor orchard pest in the oriental-Australian region (Van der Geest and Evenhuis 1991) and has also been recorded from the introduced *Mimosa pigra* (Mimosaceae) in the Northern Territory (Wilson *et al.* 1990).

8 *M. quinquenervia* flowers unavailable.

9 Larva collected within "puff-ball" gall.

10 *Holocola thalassinana* also feeds upon *Leptospermum laevigatum* (Meyrick 1882, 1911; McQuillan 1992).

11 All *Strepsicrates* identifications are tentative as the genus needs revision and species can only be reliably identified by dissection.

12 Larvae bored through tip-galls.

13 Adult emerged from woody fruit. May have been collected as a larva or pupa.

the most appropriate currently available, but generic assignments are tentative only. The staff at the U.S. Dept. of Agriculture's Australian Biological Control Laboratory (ABCL) associated the larvae with the identified adults. A representative series of specimens will be held at the ABCL, while the majority of specimens will be deposited at the Australian National Insect Collection (ANIC) in Canberra.

The Tortricidae were collected and reared on *M. quinquenervia* or one of five of its close relatives in the *M. leucadendra* complex: *M. leucadendra*, *M. dealbata* S.T. Blake, *M. viridiflora* Sol. ex Gaertn., *M. nervosa* (Lindl.) Cheel, and *M. cajuputi* Powell. Records for specimens of several of the same tortricid species collected on *Callistemon viminalis* (Sol. ex Gaertn.) G. Don ex Loudon, *Eucalyptus ?tessellaris* F. Muell. and *Lophostemon suaveolens* (Sol. ex Gaertn.) Peter G. Wilson & J.T. Waterhouse (all Myrtaceae) also are presented.

Our collecting was concentrated in two main regions of the Australian east coast. In northern Queensland (NQ), our regularly sampled sites ranged from the Daintree River, north of Cairns, to Townsville. Our second major collecting region was from Coolumb in southeastern Queensland (SQ) to Grafton in northern New South Wales (NSW). Most of the site locations in this paper have been listed in the three previous papers in this series (Balciunas *et al.* 1993a, 1993b, Burrows *et al.* 1994). The NQ sites listed here for the first time are: **Alva Beach** (19°27.5'S 147°28.9'E), 15 km NE of Ayr; **Eclipse Street*** (19°14.4'S 146°47.2'E), Townsville; **Rowes Bay Golf Club*** (19°13.8'S 146°46.5'E), Townsville; and **Willows Shopping Centre*** (19°19.1'S 146°43.5'E), Townsville. The SQ sites listed here for the first time are: **Ernest** (27°55.5'S 153°23.2'E), 62 km SE of Brisbane GPO; **Landsborough** (26°48.2'S 152°58.9'E), Brisbane; **Redbank*** (27°36.1'S 152°52.9'E), 21 km SW of Brisbane GPO; **Tennyson*** (27°31.5'S 152°59.4'E), 7 km SSW of Brisbane GPO; and **Woodford** (26°55.6'S 152°46.1'E), 68 km NW of Brisbane GPO. We also present records from NSW at **Macleay** (29°26.9'S 153°13.7'E), 145 km S of Coolangatta GPO and the Northern Territory at **Howard River** (12°27.7'S 131°04.9'E), 31 km W of Darwin. Sites marked with an asterisk (*) are either ornamental plantings or forest remnants in urban areas.

Results

Our collection and rearing records for Tortricidae are presented in Table 1.

Discussion

There are assumed to be about 1230 species of Tortricidae in Australia (Nielsen and Common 1991), half of which are named. The majority of Australian tortricids are believed to have coevolved with the Australian plant communities, most notably with eucalypts and other Myrtaceae (Common 1980). Common (1980) reported that out of 199 reared species, 53 were from

Eucalyptus spp. Two separate groups within the Tortricidae concentrate on myrtaceous host plants, the tribe Epitymbiini in the Tortricinae and several genera of the tribe Eucosmini in the Olethreutinae. The Epitymbiini largely feed on dead leaves, including the 40 species reared from dead eucalypt leaves (Common 1980). A majority of the few species reared in the genera *Strepsicrates* Meyrick, *Holocola* Meyrick, *Bathrotoma* Meyrick and related eucosmine genera have myrtaceous host plants (ANIC rearing records, McQuillan 1992). For the present study, we reared some 21 tortricid taxa from a few *Melaleuca* species, without sampling dead leaves. Half of these belong to the Eucosmini, often to closely related species or species complexes, emphasising the group's strong relationship with myrtaceous host plants.

Host records for 21 reared taxa are presented in this paper. Three of the Tortricidae collected are known polyphages: *Dudua aprobola*, *Epiphyas postvittana* and *Isotenes* cf. *miserana*. The only published records of Tortricidae from *Melaleuca* that we could find are from Common (1990), who indicated that *Bathrotoma constrictana* Meyrick and *E. postvittana* had been reared from unspecified species of *Melaleuca*. Thus the host records presented here are apparently all new and, for 17 of these taxa, appear to be the first published.

Although several other *Strepsicrates* species are known to cause damage to eucalypts in nurseries and plantations (Van der Geest and Evenhuis 1991), this only highlights their potential usefulness in retarding plant growth. The three *Strepsicrates* species we collected are reasonably common and could be promising potential biological control agents, if any prove to be sufficiently host-specific. Worldwide, nine tortricid species have been released as biological control agents for weeds (Julien 1992), including one *Strepsicrates* species. The larvae of the three *Strepsicrates* species we collected bind young tips, or feed on the flowers, of *M. quinquenervia*. Their feeding activities damage new tips, thus restricting branch growth. Young *M. quinquenervia* tips are most prevalent from July to November, when the flush of young growth appears following the end of the winter flowering period. Identifying the adults of these species is frequently difficult and distinguishing the larvae, especially while they are alive, has usually not been possible. This will be a significant impediment to developing these species as biological control agents. "*Bathrotoma*" *quietana* and *Holocola* sp. B are also damaging, but less common and might be considered as biocontrol agents if sufficient numbers can be collected to determine their host range.

Acknowledgments

We thank Dr B. Barlow for identifying the *Melaleuca* species and G.J. Bowman, L.M. Brown, P.K. Jones, J.R. Makinson, C.R. Maycock and M.F. Purcell for help in collecting and rearing insects. This study is funded by U.S.A. Federal and State of Florida Agencies: USDA-ARS-Office of

International Research Programs; U.S. Army Corps of Engineers (Jacksonville District); National Park Service; Florida Dept. Environmental Protection; South Florida Water Management District; Lee and Dade Counties, Florida.

References

- BALCIUNAS, J.K., BOWMAN, G.J. and EDWARDS, E.D. 1993 a. Herbivorous insects associated with the paperbark *Melaleuca quinquenervia* and its allies: I. Noctuoidea (Lepidoptera). *Australian Entomologist* **20**: 13-24.
- BALCIUNAS, J.K., BURROWS, D.W. and EDWARDS, E.D. 1993 b. Herbivorous insects associated with the paperbark tree *Melaleuca quinquenervia* and its allies: II. Geometridae (Lepidoptera). *Australian Entomologist* **20**: 91-98.
- BARLOW, B.A. 1988. Patterns of differentiation in tropical species of *Melaleuca* L. (Myrtaceae). *Proceedings of the Ecological Society of Australia*. **15**: 239-247.
- BLAKE, S.T. 1968. A revision of *Melaleuca leucadendron* and its allies (Myrtaceae). *Contributions of the Queensland Herbarium, No.1*. Queensland Herbarium, Department of Primary Industries, Brisbane. 114 pp.
- BURROWS, D.W., BALCIUNAS, J.K. and EDWARDS, E.D. 1994. Herbivorous insects associated with the paperbark tree *Melaleuca quinquenervia* and its allies III. Gelechioidea (Lepidoptera). *Australian Entomologist* **21**: 137-142.
- COMMON, I.F.B. 1980. Some factors responsible for imbalances in the Australian fauna of Lepidoptera. *Journal of the Lepidopterists' Society* **34**: 286-294.
- COMMON, I.F.B. 1990. *Moths of Australia*. Melbourne University Press, Melbourne. xxxii + 535 pp.
- JULIEN, M.H. (ed.). 1992. *Biological control of weeds: A world catalogue of agents and their target weeds*. C.A.B. International, United Kingdom. 186 pp.
- McQUILLAN, P.B. 1992. A checklist of the Tasmanian tortricid moths (Lepidoptera: Tortricidae) and their host-plant relationships. *Papers and Proceedings of the Royal Society of Tasmania* **126**: 77-89.
- MEYRICK, E. 1882. Descriptions of Australian micro-Lepidoptera VI. Tortricina. *Proceedings of the Linnean Society of New South Wales*. **6**: 629-706.
- MEYRICK, E. 1911. Revision of Australian Tortricina. *Proceedings of the Linnean Society of New South Wales*. **36**: 224-303.
- NIELSEN, E.S. and COMMON, I.F.B. 1991. Lepidoptera (moths and butterflies). Pp 817-915 In: *The Insects of Australia*. Melbourne University Press, Melbourne.
- SWAINE, G., IRONSIDE, D.A. and CORCORAN, R.J. 1991. *Insect pests of fruit and vegetables*. 2nd edition. Queensland Department of Primary Industries, Information Series Q191018, Brisbane. 126 pp.
- SUCKLING, D.M., ROGERS, D.J. and SHAW, P.W. 1990. Disruption of lightbrown apple moth *Epiphyas postvittana* (Walker) (Lepidoptera: Tortricidae) trapping in Nelson, New Zealand. *Australian Journal of Zoology* **38**: 363-373.
- VAN DER GEEST, L.P.S. and EVENHUIS, H.H. (eds.). 1991. *Tortricid Pests: Their Biology, Natural Enemies and Control*. Elsevier, Amsterdam. xviii + 808 pp.
- WILSON, C.G., FLANAGAN, G.J. and GILLET, J.D. 1990. The phytophagous insect fauna of the introduced shrub *Mimosa pigra* in northern Australia and its relevance to biological control. *Environmental Entomology* **19**: 776-784.